Working Group on Data Assimilation and Numerical Weather Prediction

At ITSC-25, Goa, India

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& WG members & attendees

https://itwg.ssec.wisc.edu/nwp/

Recap of agenda of the DA/NWP WG meeting

1. Welcome
2. Review of progress of action items from the last meeting
3. WMO (CGMS) High Level Priority Plan Items
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4. Other items for discussion:
   - 4.1 Use of WIS2.0 as means to obtain satellite data.
   - 4.2 possible evolution of NWPSAF services
   - 4.3 Forthcoming changes to satellite constellations
   - 4.4 Request by Products group to consider Metadata for AI

5. WIGOS vision rewrite (Fiona & Heikki)

6. Website , Survey, Scope of group

7. Review of standing Action & recommendations

8. AOB

Actions Since Last Meeting

The majority of actions are closed. The WG discussed the following open actions:

Action DA/NWP 24-6 on WG Members: Share impact assessment results for FY-3E with the working group, NOAA and CMA as soon as possible in particular to provide evidence for support of the early morning orbit. Still interested in this e.g. online reports, presentations

Status: **ONGOING. Please let us know of any papers on this**

We decided to keep this open and encourage WG members to share results. Intend to review at intermediate meeting

Action DA/NWP 24-4 on WG co-chairs: Organise a task team to perform experiments to establish the impact of data latency (esp. DBNet data) in both global and local assimilation systems.

Status: **CLOSED and replaced by 25-1**

WG recognises that the WMO DBNet Coordination group and all contributing stations provide a dedicated service to provide data with a high timeliness. This is especially important for NWP applications that have a short cutoff time. Consequently, we want to support this effort.

ACTION DA/NWP 25-1 on WG co-chairs: To organise an online meeting within 2025 to discuss with WG members the approach to assess and provide feedback on DBNet. Prior to the meeting gather statistics of usage via email.

WMO CGMS HLPP

Concerning Principal Component Scores representation of hyperspectral radiances

4.2.6 Establish together with the user community a commonly agreed approach for retrieval of Principal Component scores and associated parameters from hyperspectral infrared data, minimizing information loss including the mutually acceptable update strategy for the principal component basis and to implement such an approach in a coordinated manner.

Data Providers are adopting the approach of global plus local PC scores (discussed at ITSC-21 Hultberg et al.) for dissemination of data from existing and planned hyperspectral instruments.If Providers have to use another approach for some reason, WG recommends that detailed documentation is available to users.

WG also notes that most NWP centres currently intend to assimilate PC scores in the form of reconstructed radiances

Our general feeling is that this has been constructively taken up by data providers

WMO CGMS HLPP

Concerning NWP specific needs for radiative transfer developments

*4.6.3 Through coordination between IPWG, ITWG, ICWG and **IESWG**, continue to improve microwave radiative transfer models to include complex surfaces (e.g., snow, desert, etc.) and scattering atmospheres (e.g., frozen hydrometeors) to support improved algorithm development for current and future sensors.*

Feedback from the WG members suggests that there is not a single key issue affecting all centres, however ongoing strands of development need further improvements for the following areas:

* modelling the solar component of the short-wave IR;

* visible reflectance simulations in the presence of both cloud and aerosol;

* ability to simulate fully polarized radiances over complex surfaces e.g. snow and sea-ice.

ACTION DA/NWP 25-2: to Chris Burrows: to pass on his short-wave IR results to the RT group.

WMO CGMS HLPP

Concerning trade off studies for IR instrument properties

4.7.2 Conduct trade-off studies regarding the benefits of spectral, radiometric, and spatial resolution of infrared sounders, taking into account aspects such as scene inhomogeneity and uncertainties in spectroscopy

The WG is not aware of any new studies addressing these questions since papers published by Wang around 2017.

WG notes that many of the forthcoming and planned hyperspectral sounders in geo orbit share similar resolution characteristics.

WMO CGMS HLPP

4.9 Identify AI/ML technologies for applying to the product processing and data management infrastructure and develop best practices

There are a wide range of active developments being pursued in the context of applying AI for satellite data assimilation:

- AI tasks embedded in “conventional” NWP systems: adjoint estimation, bias correction, radiative transfer, estimation of radiative properties for complex surfaces, monitoring
- AI replacing analysis or forecast components
- DOP

At this time, there is no preferred methodology that all centres are adopting. Keep this under review at future meetings

User Led Items

Status of WIS2.0

A short update was given on the status of WIS2.0, which is scheduled to replace the GTS as the main data transmission mechanism by 2030, was given by Simon Elliott.

ACTION DA/NWP 25-3: to WG Members: to report back to their respective technical departments regarding this ongoing transition to WIS2.0, in order to ensure a smooth transition in satellite data reception.

User Led Items

EUMETSAT NWP SAF - possibilities for future evolution of services

The NWP SAF service relevant to use of satellite sounder data were presented to the WG, inviting feedback for future improvements.
Discussion highlighted following:

- Support for ML based forward model, noting requirement in NWP systems for good quality Jacobians
- NWP centres are using the 1D-Var package for a wide range of uses
- Concerning pre- processing packages
  - No obvious gap in planned upgrades for new instruments
  - Interest in several enhancements to IRSPP, including superobbing capability

ACTION DA/NWP 25-4 to WG co-chairs: To present this feedback to the NWPSAF project team as input to their planning activities

User Led Items

Meta Data for ML as output from Pre-Processing Packages

This item was raised by the Products WG.

During the discussion a few useful parameters were mentioned.

- instrument temperature
- satellite orbital angle
- determination of land or sea in field of view (either based on observations or from ancillary data).

.The range of parameters may evolve as research into ML methods progress

We will retain this as an Agenda item for next meeting

Upcoming changes to Satellite Constellations - hyperspectral IR

WG was pleased to see the plans for more hyperspectral infrared geostationary sounders in space. In Talks at this conference concerning:

- GHMS (JMA)
- GXS (NOAA/NASA)
- GEOHIS (KMA)

to complement

- existing GIIRS (CMA)
- upcoming IRS (Eumetsat).

Recommendation DA/NWP-25-1: to space agencies and CGMS: Continue their efforts to launch hyperspectral sounders in geostationary orbit in order to achieve continuous coverage in the geostationary ring.

Upcoming changes to Satellite Constellations - SmallSat/CubeSat constellations

WG notes that 118 GHz band is frequently included in new SmallSat/CubeSat designs

Recommendation DA/NWP 25-2 to NWP centres: perform studies to investigate the operational use and impact of the 118 GHz band.

In the discussion the recommendations of previous ITSC meetings were reviewed and are now adopted as standing recommendations in view of the increasing number of constellations of small satellites.

These are presented on the next slide

Recommendation DA/NWP Standing-9 to CGMS: Communicate to satellite data providers that the stability and consistency of bias and noise for individual passive radiometer instruments within a constellation of SmallSat/CubeSats are very important for implementation. Consistency between instruments within the constellation is also critical.

Recommendation DA/NWP Standing-10 to CGMS: Communicate to satellite data providers that given Recommendation DA/NWP Standing-9, the requirement from NWP Centres for single instrument longevity within any constellation of SmallSat/CubeSats should be a threshold of 3 years post-commissioning (below which many centres will not use the data) and an objective of 5 years (where most NWP centres will aim to use the data). If the overall mission is of long duration, the threshold for an individual satellite could be lowered to 2 years post-commissioning.

Recommendation DA/NWP Standing-11 to CGMS and data providers: Radiance data from new satellite instruments should be disseminated using WMO pre-approved BUFR sequences, consistent with other similar data types where possible.

Recommendation DA/NWP Standing-12 to WMO: Continue to engage with commercial satellite providers to convey NWP requirements via industry days etc.

Recommendation DA/NWP Standing-13 on CGMS and WMO members: When commercial satellite data is purchased, ensure provision to users of the necessary data and meta-data required to make use of the data in applications, as early as possible.

WG Standing Actions

- **Action DA/NWP- Standing 1 on ITSC Co-chairs:** To bring relevant recommendations to the attention of CGMS.
- **Action DA/NWP- Standing 2 on DA/NWP WG members:** Send any evidence of RFI to co-chairs of the RFI Technical SubGroup
- **Action DA/NWP- Standing 3 on DA/NWP WG members:** If you have estimates of revised channel characteristics resulting from post-launch diagnostics, please email these to brett.candy@metoffice.gov.uk & radiative transfer working group chairs (Benjamin.T.Johnson@noaa.gov & vito.galligani@cima.fcen.uba.ar).
- **Action DA/NWP- Standing 4 on NWP centres:** Continue to provide information on instrument channels assimilated and their observation errors via the working group survey spreadsheet in advance of each conference.
- **Action DA/NWP- Standing 5 on DA/NWP WG Members:** Make suggestions and corrections to the DA/NWP Working Group website

WG Standing Recommendations 1/2

Recommendation DA/NWP-Standing 1 to the Satellite Agencies: In support of maintaining a robust global satellite observing system, instrumentation to allow continued sounding of the temperature of the upper stratosphere and mesosphere (for example comparable to.SSMIS UAS channels or limb sounding) should be explored.

Recommendation DA/NWP-Standing 2 to funding bodies of NWP centres and space agencies: Consider, as part of the cost of satellite programmes, providing computational and personnel resources targeted at operational NWP centres to optimise the public's return on investment from these expensive measurement systems.

Recommendation DA/NWP-Standing 3 to Space Agencies and data providers: When designing new or modified BUFR formats, please circulate drafts to the NWP community via the NWP Working Group for feedback, prior to submission to WMO.

Recommendation DA/NWP-Standing 4 to Data Providers: When using PC compression, noise normalisation should be performed using the full noise covariance matrix.

WG Standing Recommendations 2/2

Recommendation DA/NWP-Standing 5 to Data Providers: If a change to data processing results in a change in brightness temperature of 0.1K or 20% of NEdT (whichever is smaller), this should be made clear in notifications to users. These notifications should be made no later than 8 weeks before the change and test data should be provided if possible.

Recommendation DA/NWP-Standing 6 to Data Providers: The overlap period where one satellite resource is replacing another should be chosen after consultation with the user community and should follow WMO guidelines.

Recommendation DA/NWP - Standing 7 to Data Providers: Provide NedT estimates for inclusion within BUFR for microwave data.

Recommendation DA/NWP - Standing 8 to Data Providers: Develop and maintain public instrument status monitoring web pages; Suggestions for useful diagnostics on the monitoring of instrument health is compiled in https://itwg.ssec.wisc.edu/nwp/wp-content/uploads/sites/5/2025/04/Instrument_performance_monitoring_apr2025.pdf